general hygienic management, little can be done for these cases, and it will be interesting to see what can be accomplished with repeated doses of epinephrin. In cases of edema of the epiglottis or larynx due to disturbance of this type epinephrin given intravenously, if its action were similar to what it has been in these cases of urticaria, might well be the means of saving life, when the local application of the drug and other measures had failed.

Another such condition is anaphylaxis, with severe bronchial spasm and edema. From its physiological action on the bronchi and peripheral vessels, epinephrin should theoretically be the most specific of any drug in these cases. That it may relieve the asthma of anaphylaxis, at least temporarily, is well known to clinicians, and its effect on certain urticarias of this type has been shown in this paper. Whether or not it could be made beneficial in every such case if the doses were properly manipulated is a question of some interest. I know of one extreme case of anaphylaxis with dyspnea, but without edema, where epinephrin had no apparent effect, though it is impossible to say what larger and more frequent doses might have done. We know too little, however, of the possible reactions which may in turn follow the primary dilatation produced by the epinephrin to give more than moderate doses in such grave cases, and this point requires further investigation.

The rapidity with which the erythema has faded in my cases suggests the possibility of using epinephrin to differentiate rashes of purely vasomotor origin from those of other types. Hayes[9] suggested its use in diagnosticating serum erythema from the rash of scarlet fever. We have not yet had an opportunity of trying it in a case of scarlet fever, but it is rational to expect that the scarlet rash would fade but little or not at all.

In concluding, I wish to thank Dr. Joseph E. Winters, whose kind permission to work in his wards at the Willard Parker Hospital enabled me to obtain the cases of serum urticaria, and also Dr. R. Hayes for many courtesies extended to me while there.

THE DISSEMINATION AND PREVENTION OF YELLOW FEVER.

By Joseph H. White, M.D.,

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In order to avoid possible misunderstandings, I shall not enter into an argument regarding the relative merits of the observations of Beauperthuy, Knott, and others, but no discussion of this subject would be fair unless it embodied the credit which is due to Carlos Finley for arraigning the stegomyia as the cause in the dissemination of yellow fever, and which did not recall the wonderful clinical observations of Carter in the Mississippi outbreak of 1898, in which he noted the apparent discrepancy between the incubative periods of the first secondary case in a house and those following it. This is true, because the notes of these two men were the most important factors in leading the United States Commission under Reed to pursue the proper line of research from the start.

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[9] Personal communication.

To that commission, Reed, Carroll, Lazear, and Agramonte, we owe the definite, conclusive, and irrefrangible proof that the female Stegomyia calopus is the transmitter of yellow fever from man to man; that she receives her infection during the first three days of the man's illness and does not herself become dynamic for evil short of ten or twelve days, and the further proof that the mosquito is the sole means for such transmission, though naturally we cannot positively say that some other of this genus may not also transmit the disease until all have been tried. It is superfluous to recite the findings of this commission, as they are known to the whole world; but because there has been some inclination shown to still believe in the transmission of the disease by fomites, I think it well to report additional facts coming under my own observation, and bearing on this phase of the matter.

During the 1905 epidemic in New Orleans I arranged that all of our prophylaxis should be based upon the findings of the Reed Commission, and, pursuant to this policy, our yellow fever hospital was screened at every opening so effectively that no mosquitoes could effect an entrance. Only one portal was provided for entrance and exit, which was fitted with triple doors, two strong electric fans blowing outward day and night, and a boy stood in the vestibule to locate and destroy any chance entrant.

All fomites, soiled bedlinen, and clothing stained with vomitus, fecal matter, and blood from over 300 patients suffering from yellow fever, was carried without any disinfection to one of the benevolent institutions of the city, where it was laundered; and this was the only institution in the city which was free from yellow fever during the epidemic of 1905.

Our hospital, containing 120 beds, was manned as to medical staff, nurses, cooks, waiters, scullions, etc., with absolute disregard for the question of immunity, and no member of the personnel became infected, save one young woman, who subsequently confessed she had violated her obligations, and had slept one night outside in what was afterward proved beyond doubt to be an infected house.

Patients were permitted to be seen by friends and relatives, and sometimes whole families were taken into the hospital and held under observation while one of their number was sick with yellow fever and their house was being fumigated, nor was there reason to suspect that infection was transmitted in this manner.

From the evidence of the commission, and from my own observation in connection with this hospital and with three or four epidemics, it appears to me there is no reason to believe that there is any other means of transmission save through the female stegomyia which has bitten an infected person during the first seventy-two hours of his fever.

The disease presents itself in what has been arbitrarily classified as endemic and epidemic form.

The endemic existence of yellow fever depends upon two factors: (1) The constant presence of mosquitoes of the genus stegomyia, and (2) the presence of a constant supply of non-immune material (people). The latter factor is supplied in two ways: one by population sufficiently large that its birth rate will supply the non-immune material, as is the case in such cities as Habana or Rio Janeiro, and the other by the steady incoming to a smaller town of people from remote places of habitation, such as is the case in communities like Cartagena, where the "paesanos," bringing Tagua nuts, are constantly arriving, resting a few days, and going home. Such cities as Guayaquil and Vera Cruz may supply both conditions.

The Stegomyia calopus is according to my observation entirely a domestic mosquito, and while I would not assert that under such conditions as might annihilate all human habitation near by that it might not breed in natural pools, it is nevertheless true that as matters ordinarily exist it always breeds in artificial water containers, such as cisterns, barrels, tubs, buckets, broken bottles, cans, stagnant drains with brick, stone, or cement sides, etc. It seems instinctively to avoid water courses having weeds and grass around their margin, and in a conversation on this subject with H. W. Thomas, of Manaos, I learned that the one breeding place known to him which was not deemed artificial, fulfilled artificial conditions in that it was a cleft in rock and free from vegetation.

Howard also states that the stegomyia gives evidence in its method of attack of long acquaintance with man, since it always attacks from the rear or under the lower edge of a garment, and never where it can be easily destroyed. He considers it almost as much domesticated as the barnyard fowl. Many have confirmed Howard's findings in this respect, also in regard to its habit of, biting at twilight after it has become accustomed to blood feeding, though prior to that time it is not so discriminating

In 1905 I called the attention of Sir Rubert Boyce to the domestic character of this mosquito, and found him somewhat incredulous regarding my statement that I had never found it in any water containers save artificial ones; but I had the pleasure some months later of meeting Dr. Boyce on his return from Central America and the West Indies, where he had verified my observations, failing to find the stegomyia in crab-holes and other natural pools.

This is *a propos* in connection with the statement of J. De Goyon[1] regarding French West African work. He states that much attention was paid to crab-holes, that vast numbers of them along the coast-offer protection to the mosquitoes, and without noticing the apparent discrepancy, and almost in immediate connection says: "Le Moal has shown that the mosquitoes which inhabit crab-holes were principally Catageiomyia senegalensis and Uranotænia annulata." He then continues: "The larvæ found in odd water receptacles almost exclusively belonged to the genus stegomyia." He calls attention to the danger from non-reported cases, and advises a change in the manner of house construction, gutters, etc. All his observations are excellent, but he fails to note that poorly constructed wooden roofs and gutters furnish excellent breeding places.

K. S. Wise[2] also notes that "Stegomyia fasciata and Culex fatigans were found only in close proximity to human habitations. . . . The larvæ of stegomyia were never present in trenches nor unoccupied ponds." This corresponds with my observations stated at the 1905 meeting of the American Society for the Advancement of Science.

Wise also states that the anophelines breed in trenches overgrown with vegetation, in hollow stumps, etc., and that clearing arrests such breeding; these facts are pertinent to this discussion, because malaria tends to confuse diagnosis, and efforts should be made to eradicate malaria coincidentally with yellow fever.

The question of the flying radius of the stegomyia has given rise to much discussion, and for that reason I would submit some further observations of my own bearing thereon.

During July, August, and September, 1905, the old French quarter of New Orleans known as the Vieux Carré was the most pronouncedly infected section of the city.

The Louisville and Nashville Railroad runs through the river side of this section to its passenger station at the head of Canal Street. I purposely permitted unscreened passenger trains of this line to go out every day, with every seat full of passengers bound through to the North, and these trains were boarded at the Mississippi-Louisiana State line by young guardsmen of the Mississippi State Guard, all of whom were non-immune, who rode in the coaches across the whole State of Mississippi with passengers to the Alabama State line, where Alabama men took up the task of seeing that these passengers did not debark in infected territory.

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[1] Revue Scientifique, September 23, 1911.

[2] Annals of Tropical Medicine and Hygiene, December 30, 1911.

I did this because there was no place where these cars would come within less than fifty yards of a dwelling house, and that no stegomyia from an infected room would fly fifty yards in the open sunshine. The result showed that my surmise was well-founded, as there was not a case of any kind of fever among these guardsmen, while there undoubtedly would have been had any infected mosquitoes been in the coaches. Naturally the coaches would have been fumigated had any illness occurred.

Again, on Burgundy Street, a long, low house, the middle one of three just alike, with windows of each exactly opposite those of the others, mostly open, and not more than fifteen to twenty feet between the houses, became infected, and so remained for about thirty-five days before it was discovered that every member of the family had the disease. Neither the neighbors to the right nor to the left visited this house, and neither did any of them contract the fever, though other people who lived at a distance who did visit the house became ill of yellow fever.

I am quoted by Rosenau as saying in 1898 that yellow fever never crossed the street save on a pair of shoes, and I am now even more convinced of the almost unfailing rule that to become infected with yellow fever one must enter a room, with a dim light, where yellow fever has been at least fifteen days before.

It is not to be denied that an infected mosquito might be imprisoned in a bag or piece of furniture and carried to some distant point *nolens volens,* but the contingency is so remote as not to be worth discussion.

It is unfortunate that so much of our work must depend upon deductive reasoning rather than facts, but it is nevertheless true, and for this reason I have submitted so much of this data.

In the sick-room the infected blood-feeding stegomyia finds all the congenial conditions of shade, blood, moisture, rest, and sunshine, and remains there, having practically changed her whole life habit since she tasted human blood; and, so far as my observation goes, she will never leave there unless the sick-room be entirely abandoned and left without even water, as happened in one instance in Baton Rouge, where an obscure case was traced to the fact that the patient slept in an open bay window, within ten feet of an old abandoned shack, where an Italian couple, who had fled from the New Orleans epidemic, camped for a week, during which time the man had a mild attack of yellow fever, and they then fled again, leaving their infected stegomyiæ behind them to infect the woman sleeping in the open bay window eighteen days later. This is the only case known to me where conditions would force the migration of the insect.

The prevention of yellow fever resolves itself naturally into: (1) The prevention of mosquitoes breeding, with the destruction where practicable of existing mosquitoes as a secondary phase; (2)

the isolation of the sick man, together with his infected mosquitoes and the final destruction of these infected mosquitoes.

The former proposition is one of interest in dealing with an endemic centre, and the latter is the one which comes to the fore in dealing with an acute outbreak demanding rapid and effective work.

In attempting to prevent breeding it is advisable to attack mosquitoes and their breeding grounds without regard for genus or species, because in so doing we shall answer the question, "May we not force the stegomyia into new breeding grounds, such as puddles, swamps, etc.," and again by attacking all mosquitoes we eliminate complications in the way of diagnosis, at least in part.

All ground within a quarter of a mile or more of the area to be treated should be reduced to ordinary dryness by drainage ditches and in the end by a system of subsoil drains, so that there will be no surface water to contend with, as ditches may pocket in places here and there and breed mosquitoes.

Thorough policing of the whole area not less frequently than once each week, and preferable once every five days, is essential, and is to be coupled with a clean-up of each water container, such as tin cans, broken bottles, etc., as well as grass and weeds in damp corners of the yard. All regular water containers, such as cisterns, barrels, buckets, tubs, fountains, church fonts, and cemetery urns, must be inspected at short intervals to see that they are not breeding mosquitoes, and to this end screens of eighteen meshes to the inch may be used on all containers, or a constantly renewed covering of refined petroleum may be applied to their surfaces. For the fountain a strong head of water and a number of small fish will suffice. The little minnows, known by the Jamaica negroes as "millions," serve this purpose. For the font, a tablet of bichloride or a small crystal of cupric sulphate, frequently renewed, is suggested, and the same rule will apply to urns, which I have seen swarming with stegomyiæ.

Experience has shown that the people will promise all these things and not do one of them, and that the paid lay inspector will attend to his duties so long as he is under the eye of the sanitarian.

Among the places to be watched as possible breeding grounds are the manholes of the city drainage and sewerage system, also the sagging roof gutter, which is a prolific source of danger, especially where shaded for most of the day. The remedy for the latter is simple: punch a hole in the dependent part with a tenpenny nail, unless it can be torn down entirely. The removal of all roof gutters, allowing the water to fall into paved ground drains and run freely away, is the ideal way to meet this question, and is the method adopted in the Canal Zone

As to the destruction of existent mosquitoes of the genus stegomyia, it is not impossible, as was proved in New Orleans, but is feasible only because of the habit of the stegomyiæ seeking dwelling with man, and making it therefore possible to destroy them by house fumigation; but such measures meet with objection in houses where there has been no fever, and it is possible that such work is better dispensed with in the interest of popular coöperation, where an endemic focus is being attacked and the work of necessity to be long continued.

In the handling of an epidemic, prompt and efficient work is necessary; this means the immediate isolation of every sick man and his accompanying mosquitoes; nor can this be too carefully done. We are confronted in this connection with the mild case in the negro and negroid, and to the cases on which it is sometimes difficult to obtain a report which we find among the younger members of the poorer class of whites unaccustomed to sending for a physician unless someone of the family is seriously ill. Two factors are predominant in these cases: (1) The ignorance of the class of the medical man usually employed by these people, and (2) the fact that these people, more than any others, object to the attentions of the health officer. It is therefore apparent that too much attention cannot be paid to the ignorant physician, to the slightly ill negro, nor to the young white child in similar case.

In dealing with the houses in which known or suspected cases of yellow fever have been discovered, it was my custom first to see whether the house had been properly screened with eighteen-mesh-to-the-inch wire cloth, and if not, to have screening done promptly, using mosquito netting as a substitute for wire cloth, and having the sick-room itself, as a double precaution, screened from the remainder of the house. The sick-room door can be easily screened by tacking two ample widths of the netting to the top and sides of the door, and attaching a wooden rod to the bottom of each width, so that the ends projecting into the door are higher than those at the side, resulting in the rod dropping into place and pulling the folds together immediately behind anyone passing through. With Guiteras I believe in careful screening, and in covering all cracks around the sick-room; also in the quietness with which this work is done, to prevent disturbing either patient or mosquito. The sick-room window should be screened from a ladder on the outside of the window. In order to prevent escape or entrance through the chimney, a cap should be placed on the top; or failing in this, some loose paper should be burned in the fireplace, with a little petroleum to make a rapid flame, and the front of the fireplace covered with a screen of wire netting.

After the patient is in condition to be removed to another room or house, three days having elapsed since he became ill, he is removed and every crack pasted over into which an insect may hide, and all drawers opened, so that the fumigant used may reach all places in the room, care being taken that no mosquitoes are shut between the outside screen and the window in closing it. The room and its contents are subjected to either sulphur dioxide or cyanide, burning pyrethrum powder or any other fumigant. The whole house is simultaneously treated in the same fashion if the patient can be removed to another house. Otherwise we must treat part at a time with more than usual care.

I have never deemed it necessary to fumigate detached neighboring houses, but I consider a contiguous and connecting house to all intents and purposes, from a sanitary viewpoint, a part of the infected house, and treat it accordingly.

On August 8, 1905, I undertook, at the request of the Governor of Louisiana and the Mayor of New Orleans, to eliminate an existent epidemic of yellow fever in New Orleans, which had presented to that time 600 known cases, scattered over forty-four square miles of territory, among a population of 335,000, and with many indeterminate foci.

I deemed it necessary, under these conditions, to make an attack on all mosquitoes in addition to killing all infected stegomyia. The result was the total elimination of all yellow fever, nearly all stegomyia, and most of the anophelines and culicidæ by the end of October.

The work was continued for one hundred days from its inception, and the amount expended in round figures was from all sources $325,000, a fraction under one cent per capita per diem.

We expended about $50,000 for hospital equipment and maintenance, and $75,000 for special treatment of infected houses, leaving $200,000 for the total cost of one hundred days of elimination work, such as would be done in an endemic centre, with permanent eradication in view and which includes the overhead charges for all the work, being therefore a more than ample estimate of the cost for this latter class of work. Making allowance for slight inaccuracies in such calculations, the cost of such work would average from six to eight mills per capita per diem—less perhaps in large cities, and more in small towns on account of undue weight of overhead charges in the latter.

The endemic centre has been destroyed at Habana by Gorgas, and later a reëstablishment of endemicity prevented by Juan Guiteras. The same thing has been done at Rio by Cruz, at Panama by Gorgas, and at Vera Cruz by Liceaga; and it cannot be doubted that the consistent application to all endemic centres of the kind of work above described will destroy endemicity in the whole world, and as epidemics are dependent on endemic seed beds for their existence, yellow fever will cease to exist, and Pasteur's postulate that it is possible to eliminate infectious diseases entirely can be demonstrated in this one.

CONCLUSIONS. The mosquito is the only disseminator of yellow fever, and the female stegomyia the only genus and species proved to be the carrier.

Yellow fever is only infective during the first three days of the attack, and the mosquito biting a patient after that time receives no infection.

The stegomyia itself cannot convey the infection to another human until after the lapse of at least ten days subsequent to the ingestion of yellow fever blood.

One attack of yellow fever generally gives immunity—not always.

Feeble susceptibility in the negro is sometimes confused with immunity.

Mild cases are the rule with that race, and this causes many cases to be overlooked.

Destruction of all breeding places for all varieties of mosquitoes, and especially stegomyiæ, anophelines, and culicidæ, is necessary in dealing with endemic foci.

Rapid anti-epidemic work may be confined to destruction of infected stegomyiæ alone; but this is short-sighted.

THE SANATORIUM OF THE FUTURE.

By Herbert J. Hall, M.D.,
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The introduction of more careful diagnosis and the decline of routine treatment, together with the gradual taking up of rational occupations and physical training, in the various sanatoria of the country has been slowly changing these institutions from rest cures in the extreme and objectionable sense to places of real reconstructive opportunity. The fact is that some of the most difficult and important cases of chronic illness cannot be adequately treated in the home, because of conflicting and unfavorable conditions, and because the physician does not have the opportunity to observe the patient or control his life for a sufficient length of time. The hospitals, as they are at present organized, cannot of course meet this requirement, so it seems probable that the sanatoria will become increasingly important as they improve their equipment.

But a great responsibility rests upon these institutions. They can no longer treat all their patients with baths and electricity. I believe they should, first of all, cease to be one-man places. No one man may hope to cope, single-handed, with all the perplexing